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Agriculture Reconstruction Assistance Program

THE BRAHMAN BREED, ITS STATUS, RECOGNITION AND VIABILITY WORLDWIDE

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Submitted by:
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To:
United States Agency for International Development
Managua, Nicaragua

Under RAISE IQC Contract No. PCE-I-00-99-00003-00
Task Order No. 802
August, 2000

INTRODUCTION

There is no question of the great importance of the Brahman breed to commercial beef production during the last 50 years. The major economic traits for beef production are reproductive efficiency, growth, feed efficiency, carcass traits, conformation, longevity, disease and parasite resistance and environmental adaptation. The Brahman breed is richly endowed with many but not all traits of important economic importance. Extreme variation exists in biological traits which are of economic importance and these traits are controlled by genetics. The variation in bioeconomic traits is comparable in magnitude between breeds and within breeds. Significant genetic changes can be made by selection both within and between breeds. However, it is not possible for any one breed to excel in all traits of economic importance to beef production. The adaptative traits which specifically suit the Brahman breed for beef production in temperate, subtropical or tropical areas include: tolerance of internal and external parasites; tolerance of high solar energy, high ambient temperature and humidity and the ability to utilize high fiber forages.

REPRODUCTIVE EFFICIENCY. Reproduction is the most important bioeconomic trait for beef production. One of the traits commonly reported as a negative for Brahman cattle is lower reproductive rate compared with European or other Bos taurus breeds. Calving percentages have been reported to be lower in both Brahman cows and bulls (Table 1).

Age at puberty is an important trait for some sectors of the beef cattle industry. Emphasis in some areas upon heifers calving at 2 years of age and early use of bulls for breeding has made early maturity an important economic trait. Brahman heifers and bulls reach puberty (sexual maturity) at older ages than do European or other Bos taurus breeds (Tables 2 and 3). Brahman heifers reach puberty at too old an age to routinely calve at 2 years of age in even the best environments and Brahman bulls must be approaching 2 years of age before they achieve the maturity required to be used in breeding herds.

Table 1. Calving percentages.

	Breed of Sire	
Breed of Dam	Brahman	European (Bos taurus)
Brahman	70.0	74.2
Brahman based	71.5	80.4
European (Bos taurus)	61.5	72.7
All cows	67.4	75.5

From: Randel (1994a).

Table 2. Age at puberty in heifers.

Breed	Number	Age at Puberty (d)

British Breeds	57	436
Brahman	22	690
Brahman x European	68	438
Brahman Based (Brangus)	114	528

From: Randel (1994a).

Table 3. Age at puberty in bulls.

Breed	Age at First Sperm, d	Age at Puberty, d
Brown Swiss	236	264
Red Poll	252	295
Angus	265	296
Angus	–	348
Hereford	266	326
Brahman	–	477
Brahman	295	454
Brahman	374	–
Brahman	397	–

From: Randel (1994b).

GESTATION LENGTH. Cows of different breeds have differing gestation lengths. Breeds with longer gestation lengths are at a disadvantage when expected to calve in an interval of 365 days or less. European and other Bos taurus breeds have been reported to have an average gestation length of 282 days (Lush, 1945). Brahman, Brahman-based and other Bos indicus breeds have longer gestation lengths with the small African Zebu being the only Bos indicus breed with gestation lengths similar to European or other Bos taurus breeds (Table 4).

Table 4. Gestation length.

Breed	Gestation Length (d)
Brahman	292.8
Brahman-Based (Brangus)	286.0
Nelore	291.4
Nelore and Guzerat	292.9
Nelore, Gir and Guzerat	292.0
Africander	295.0
Africander	295.0
African Zebu	282.7
Ethiopian Zebu	283.0

From: Randel (1994a).

POSTCALVING FERTILITY. The primary reason that more Brahman cows are open at the end of the breeding season than European or other Bos taurus breeds is that they do not come into estrus during the breeding season (Reynolds, 1967). Reynolds (1967) found that the interval from calving to estrus was the shortest in Angus and longest in Brahman cows (Table 5).

Table 5. Interval from calving to estrus.

Breed	Interval (d)
Hereford	59
Angus	63
Brangus	74
Brahman	79

From: Reynolds (1967).

Fertility of Brahman cows is similar to European or other Bos taurus breeds of cows, if they return to estrus. The interval from calving to conception in well-managed Brahman herds indicates that fertility of Brahman cows can be very high (Table 6). With an average gestation length of 290 days, a cow must conceive within 75 days after calving to have a calving interval of 365 days or less. All herds of Brahman cows reported by Plasse et al. (1968) achieved average intervals from calving to conception of less than 75 days.

Table 6. Interval from calving to conception in Brahman cows.

Ranch	Number of Cows	Interval (d)
A	114	61
B	285	71
C	132	72
D	380	59
All	911	65

From: Plasse et al. (1968).

INFLUENCE OF HEAT STRESS ON FERTILITY. The detrimental effects of heat stress on fertility are less pronounced in heat tolerant breeds of cattle such as the Brahman. A recent experiment (Rocha *et al.*, 1998) found that oocytes collected from Holstein cows subjected to high environmental temperature and humidity were of poor quality compared to those collected from Brahman cows. When these oocytes were fertilized in vitro and incubated through developmental stages allowing for transfer to recipient cows, none of the oocytes from Holstein cows (Table 7) resulted in embryos capable of being transferred, yet reasonable numbers of Brahman oocytes (Table 8) would have resulted in pregnancies.

Table 7. Percentage of normal oocytes collected from Holstein cows and embryo development from the 2 cell to the blastocyst stage.

Season	Total Number of Oocytes	Percentage of Normal Oocytes	Percentage of Oocytes Developing To[a]			
			$\geq$2-cell (48 hours)	$\geq$8-cell (96 hours)	Morula (144 hours)	Blastocyst (192 hours)
Cool	67	80.0±19.1^{b}	59.8±11.7	44.4±12.7^{d}	34.2±12.7^{d}	29.0±14.8^{d}
Hot	28	24.6±6.3^{c}	52.3±10.6	1.1±4.8^{e}	0^{e}	0^{e}

[a]Numbers in parentheses indicate the number of hours post insemination. Normal and abnormal oocytes were fertilized.

Means in the same column with different superscripts differ: $^{bc}P=0.01$; $^{de}P\leq 0.003$.

From: Rocha et al. (1998).

Table 8. Percentage of normal oocytes collected from Brahman cows and embryo development from the 2 cell to the blastocyst stage.

Season	Total Number of Oocytes	Percentage of Normal Oocytes	Percentage of Oocytes Developing To[a]			
			$\geq$2-cell (48 hours)	$\geq$8-cell (96 hours)	Morula (144 hours)	Blastocyst (192 hours)
Cool	83	83.3±17.4	83.1±10.7	71.3±11.6	55.5±12.2	52.3±13.5
Hot	89	77.0±6.3	79.3±10.6	69.9±4.8	58.1±4.8	41.3±7.2

[a]Numbers in parentheses indicate the number of hours post insemination. Normal and abnormal oocytes were

fertilized.
From: Rocha et al. (1998).

This adaptation allowing for normal fertility in the Brahman cows during periods of high environmental temperatures with high humidity alone makes the Brahman breed important for beef production worldwide.
LONGEVITY. Cows with greater longevity allow the breeder to be more selective when choosing replacement females. While this will result in longer generation intervals, the herd will consist of more mature cows which are usually more productive. A long term (14 year) study of the productive longevity of beef cows indicated that Brahman cows lasted longer in the herd because they were more structurally sound and had fewer mammary problems than other breeds; yet more Brahman cows were culled for reproduction (Rohrer *et al.* 1988). The Brahman cows that were culled for reproduction were culled as young cows where they were expected to calve once by 3 years of age. Brahman crossbred cows had the longest productive lives of the cattle studied (Table 9).
Table 9. Longevity and reasons for removal.

Breed	Mean life (yr)	Reason for Culling (%)	
		Unsoundness	Reproduction
Angus	10.3	27.6	17.2
Hereford	9.8	36.4	20.0
Brahman	9.7	13.3	33.3
Angus x Brahman	14.6	28.1	9.4
Brahman x Hereford	13.2	17.9	20.5

From: Rohrer et al. (1988).

HYBRID VIGOR. When two different breeds are crossed, this results in heterosis or hybrid vigor. Maximum hybrid vigor occurs when totally unrelated animals are crossed. The Brahman is of the Bos indicus species and when crossed with European or other Bos taurus breeds, maximum hybrid vigor occurs in the offspring. The first cross (F_1) produced from crossing the Brahman with a Bos taurus breed produces an exceptional animal. Crossbreeding increases female productivity in any case but heterosis in the Brahman F_1 is much greater than for other crosses (Table 10). This greater heterosis results in improved percent of cows calving, calves weaned and increased weaning weight of the calves and increased weight of calf weaned per cow exposed (Table 11).
Table 10. Heterosis (%) for female reproductive traits.

	Calving Rate (%)	Weaning Weight (kg)
Brahman CROSS		
Study A	8.1	8.7
Study B	14.6	7.3
Study C	12.6	17.5
Average	11.8	11.2

Bos Taurus CROSS		
Study A	7.5	4.3
Study B	8.3	3.3
Study C	2.6	5.1
Average	6.1	4.2

From: Long (1980).

Table 11. Breed group means for production and maternal performance of crossbred cows.

Breed Groups	# Births	Born %	Weaned %	Calvings Unassisted %	Birth Wt. lbs	200-Day Wt., kg	
						Per Calf Weaned	Per Cow Exposed
Hereford/Angus Cross	1,685	91	84	87	86	216	182
Shorthorn/Hereford or Angus Cross	183	93	87	90	94	240	209
Brangus/Hereford or Angus Cross	238	90	86	86	87	225	193
Santa Gertrudis/ Hereford or Angus Cross	170	90	82	94	84	229	188
Brahman/Hereford or Angus Cross	**519**	**94**	**86**	**99**	**83**	**245**	**210**
Simmental/Hereford or Angus Cross	872	89	83	83	91	237	197
Maine-Anjou/ Hereford or Angus Cross	468	94	86	89	96	237	204
Limousin/Hereford or Angus Cross	851	89	82	88	88	220	180
Charolais/Hereford or Angus Cross	264	89	80	91	91	230	184

From: Data compiled at MARC.

The combination of increased heterosis for reproductive and maternal traits results in the Brahman F_1 female producing the greatest amount of calf per cow exposed and coupled with a greater longevity she will produce a greater number of calves which consistently wean at heavy weights. The Brahman F_1 cow has been proven to be the most reproductively efficient cow for commercial beef production.

FRAME SIZE AND PERFORMANCE. There has been a trend for breeders to prefer increased size, particularly height. Frame size is defined by hip height and is correlated with growth. Selection for increased frame size produces animals with increased growth rate which may be advantageous for slaughter cattle but may be having a negative influence on female reproductive efficiency.

A recent study (Vargas *et al.*, 1999) compared small (116.0 to 125.5 cm), medium (126.0 to 133.5 cm) and large (134.0 to 145.5 cm) frame size Brahman females with frame size determined at 18 months of age. Females were monitored for age at puberty and large frame size heifers reached puberty when 39 days older than small frame size heifers (Table 12). Fertility as 2-year old heifers was not affected by frame size but rebreeding performance as first calf cows was lower in large frame size females. Fertility as mature cows was greatest in the small frame size females (Table 13). Weaning rates of first and second calf cows were lower in large frame size cows but were not affected by frame size in mature cows (Table 14). These results clearly show that large frame size young cows are at a disadvantage with regard to reproductive efficiency.

Table 12. Effect of frame size on puberty in Brahman heifers.

Frame Size	Age at Puberty (days)
Small (116.0 - 125.5 cm)	633±12[a]
Medium (126.0 - 133.5 cm)	626±12[a]
Large (134.0 - 145.5 cm)	672±17[b]

[a,b]Means with different superscripts differ (P<.05).

From: Vargas et al. (1999).

Table 13. Effect of frame size on calving rate in Brahman females.

Frame Size	Calving Rate (%)		
	First Calving	Second Calving	Third or Greater Calving
Small (116.0 - 125.5 cm)	93.5±3.1	65.8±5.4[a]	93.5±3.4[c]
Medium (126.0 - 133.5 cm)	88.5±2.7	69.0±4.8[a]	78.5±4.0[d]
Large (134.0 - 145.5 cm)	97.3±6.8	41.0±8.4[b]	79.8±5.3[d]

[a,b]Means with different superscripts differ (P<.05).

[c,d]Means with different superscripts differ (P<.05).

From: Vargas et al. (1999).

Table 14. Effect of frame size on weaning rate in Brahman females.

Frame Size	Weaning Rate (%)		
	First Calving	Second Calving	Third or Greater Calving

Small (116.0 - 125.5 cm)	75.0±5.3[a]	64.9±5.8[a]	71.8±5.3
Medium (126.0 - 133.5 cm)	74.3±4.7[a]	59.8±5.2[a]	68.5±6.3
Large (134.0 - 145.5 cm)	46.2±11.8b	38.3±9.0[b]	75.8±8.3

[a,b]Means with different superscripts within a column differ (P<.05).
From: Vargas et al. (1999).

As expected, birth weights of calves produced by Brahman females with different frame sizes were different. Birth weights were always lightest in small, intermediate in medium and heaviest in large frame size Brahman cows (Table 15). Preweaning average daily gains and weaning weights were similarly influenced by frame size of the cows (Tables 16 and 17). Selection for greater frame size increased birth weight, preweaning averaged daily gain and weaning weight. This has been a general trend in the Brahman breed as well as in most breeds of beef cattle.

Table 15. Effect of cow frame size on birth weight of Brahman calves.

Cow Frame Size	Birth Weight (kg)		
	First Calving	Second Calving	Third or Greater Calving
Small (116.0 - 125.5 cm)	28.0±.7[a]	30.1±1.2[a]	29.9±.7[a]
Medium (126.0 - 133.5 cm)	31.4±.6[b]	34.2±.8[b]	33.9±.9[b]
Large (134.0 - 145.5 cm)	36.0±1.4[c]	37.8±2.0[b]	38.6±1.2[c]

[a,b,c]Means with different superscripts within a column differ (P<.05).
From: Vargas et al. (1999).

Table 16. Effect of cow frame size on average daily gain of Brahman calves.

Cow Frame Size	Calf Average Daily Gain (g/day)		
	First Calving	Second Calving	Third or Greater Calving
Small (116.0 - 125.5 cm)	747[a]	815[a]	831[a]
Medium (126.0 - 133.5 cm)	837[b]	817[a]	858[a]
Large (134.0 - 145.5 cm)	900[b]	922[b]	958[b]

[a,b]Means with different superscripts within a column differ (P<.05).
From: Vargas et al. (1999).

Table 17. Effect of cow frame size on weaning weight of Brahman calves.

	Weaning Weight (kg)		
Cow Frame Size	First Calving	Second Calving	Third or Greater Calving

Small (116.0 - 125.5 cm)	192.7±4.4[a]	191.4±9.7	199.2±7.0[a]
Medium (126.0 - 133.5 cm)	216.3±3.9[b]	191.8±6.9	203.3±8.5[a]
Large (134.0 - 145.5 cm)	226.0±7.0[b]	193.9±16.0	231.2±10.8[b]

[a,b]Means with different superscripts within a column differ (P<.05).
From: Vargas et al. (1999).

Production per cow was influenced by cow frame size. As young cows at first and second calvers, production was lowest in the large frame size cows (Table 18). As first calf cows, production was low in the large frame size females because survival rate was low (Table 19) where as second calf cows, the large frame cows failed to rebreed (Table 13). Calving difficulty was a primary factor in calf survival at first calving in the large frame size females was probably due to the increased birth weights (Table 15). Selection for larger animals improved growth rates but reduced reproductive efficiency in Brahman females. Selection for frame size and growth have resulted in increased birth weight and increased calving difficulty when calves are sired by Brahman bulls. Selection for frame size and growth has resulted in heifers which reach puberty at older ages and which have lower reproductive efficiency as first or second calvers.

Table 18. Effect of cow frame size on production per Brahman cow

Cow Frame Size	Calf Production Per Cow (kg)		
	First Calving	Second Calving	Third or Greater Calving
Small (116.0 - 125.5 cm)	143.3±11.6[a]	121.8±11.8[a]	140.6±12.3
Medium (126.0 - 133.5 cm)	161.9±10.2[a]	115.4±10.6[a]	150.3±14.3
Large (134.0 - 145.5 cm)	102.9±25.7[b]	80.5±18.3[b]	176.8±19.8

[a,b]Means with different superscripts within a column differ (P<.05).
From: Vargas et al. (1999).

Table 19. Effect of cow frame size on survival of Brahman calves.

Cow Frame Size	Survival Rate (%)		
	First Calving	Second Calving	Third or Greater Calving
Small (116.0 - 125.5 cm)	80.7±5.2[a]	97.5±6.4	77.6±4.8
Medium (126.0 - 133.5 cm)	83.4±4.7[a]	88.1±4.3	86.9±6.6
Large (134.0 - 145.5 cm)	47.9±11.0[b]	93.9±10.3	95.7±8.9

[a,b]Means with different superscripts within a column differ (P<.05).
From: Vargas et al. (1999).

Average birth weights of Brahman calves have increased over time. Vargas *et al.* (1999) report an average birth weight of 32.3±.4 kg compared with a report by Reynolds *et al.* (1980) with an average birth weight for Brahman calves of 25.8 kg. In a review, Plasse (1978) reported average unadjusted birth weights of Brahman calves in Latin America of 27.2 kg and in the United States of 28.4 kg. A positive within breed correlation of +.37 has been found between birth weight and adult hip height. Care must be taken by Brahman breeders throughout the world to produce cattle with adequate frame size and growth rate which are not too large to have high reproductive efficiency.

Many beef cattle production environments have limited nutrition from the grasslands available to support beef production. Extremely large frame size animals have increased nutrient requirements. The size of the animal must be matched with the nutrients available for maximum efficiency of beef production. Continued selection for even larger Brahman cattle in the showring jeopardizes the viability of the Brahman breed on a worldwide basis for maternal traits. The variation that exists in economically important traits for beef production is controlled genetically. Differences are great within breed and between breeds and the range in differences are as great within as between breeds for these traits. Significant genetic change occurs due to selection within breeds (Cundiff, 1993a). Antagonistic relationships exist between economically important traits and particularly between growth and reproduction. It is impossible for selection to improve all economically important traits simultaneously.

Maternal trait selection will make progress at the expense of some growth traits and selection for growth traits will be at the expense of maternal traits. Brahman breeders must decide whether they wish to produce cattle with strong maternal traits or strong growth traits.

GROWTH TRAITS. Brahman cattle are recognized worldwide as having excellent growth traits when forage is the principal feedstuff. Brahman F_1 cattle have growth rates which compare favorably to Bos taurus F_1 crossbred cattle (Table 19).

Table 19. Growth of crossbred calves.

Breed	Preweaning Average Daily Gain (g)	Postweaning Average Daily Gain (g)		Postyearling Bodyweight (kg)	
		Males	Females	Males	Females
Angus x Hereford	690	1,060	586	443	352
Brahman crosses	770	1,050	557	460	377
Devon crosses	710	990	559	429	357
Holstein crosses	710	1,110	625	454	383

From: Long (1980).

Growth rates of Brahman crossbred cattle as well as purebred Brahman cattle are competitive in the temperate as well as subtropical and tropical zones in the feedlot and superior on tropical and subtropical forages. Carcass traits of Brahman and Brahman crossbred cattle are not competitive for temperate zone beef production systems. Brahman crossbred cattle produce tougher carcasses with less marbling, lower USDA grade and lower sensory panel scores (Table 20).

Table 20. Breed group means for factors identified with meat quality in steers with Hereford or Angus dams.

Breed Crosses	Marbling	USDA Choice	Warner-shear (lb)[b]	Sensory Panel Scores[c]		
				Flavor	Juiciness	Tenderness

Chianiana-X	8.3	24	7.9	7.3	7.2	6.9
Limousin-X	9.0	37	7.7	7.4	7.3	6.9
Brahman-X	9.3	40	8.4	7.2	6.9	6.5
Gelbvieh-X	9.6	43	7.8	7.4	7.2	6.9
Sahiwal-X	9.7	44	9.1	7.1	7.0	5.8
Simmental-X	9.9	60	7.8	7.3	7.3	6.8
Maine-Anjou-X	10.1	54	7.5	7.3	7.2	7.1
Tarentaise-X	10.2	60	8.1	7.3	7.0	6.7
Charolais-X	10.3	63	7.2	7.4	7.3	7.3
Brown Swiss-X	10.4	61	7.7	7.4	7.2	7.2
Pinzgauer-X	10.8	60	7.4	7.4	7.2	7.1
South Devon-X	11.3	76	6.8	7.3	7.4	7.4
Hereford-Angus-X	11.3	76	7.3	7.3	7.3	7.3
Red Poll-X	11.5	68	7.4	7.4	7.1	7.3
Jersey-X	13.2	85	6.8	7.5	7.5	7.4

[a]Marbling: 8 = slight, 11 = small, 14 = modest, 17 = moderate.
[b]Shear force required for a 1 inch core of cooked steak.
[c]Taste panel scores: 2 = undersirable, 5 = acceptable, 7 = moderately desirable, 9 = extremely desirable.
From: Cundiff (1993b).

Because of perceived problems with respect to carcass traits, Brahman and Brahman crossbred cattle have been discriminated against by feedlots and packers (Johnson *et al.*, 1990). As the percentage of Brahman breeding increased, the shear force values increased and sensory panel tenderness scores decreased. Percentage of Brahman breeding did not effect flavor or juiciness. Many other authors support these findings that meat from Brahman cattle is less tender (Christensen *et al.*, 1991; Knapp *et al.*, 1989; Koch *et al.*, 1988; Shackelford *et al.*, 1991; Wheeler *et al.*, 1990; Van Koevering *et al.*, 1995).

The percentage of Brahman blood increases the variation in tenderness (Crouse *et al.*, 1989). Some Brahman cattle had acceptable shear force values, tenderness scores, juiciness scores and flavor scores. A small percentage of Brahman carcasses were deemed unacceptable. There are proven treatments that can overcome any real problems with carcass traits in Brahman and Brahman crossbred cattle. These treatments are postmortem aging, high voltage electrical stimulation and blade tenderization (Wheeler *et al.*, 1990). A combination of at least 14 days of aging and electrical stimulation can assure tenderness in carcasses from Brahman crossbred cattle but carcasses from Brahman cattle require these treatments plus blade tenderization to assure acceptable tenderness for the food service industry. Failure of the packing industry to adopt these techniques is responsible for continued discrimination against Brahman carcasses.

PERFORMANCE TESTING. Performance testing is an excellent method to evaluate growth and feed efficiency in bulls. Both test station and on-farm testing systems are valid methods with each having its advantages and disadvantages. Test station results can evaluate a group of bulls from many farms which will improve a breeder's ability to know how his cattle compare with other breeder's cattle. On-farm testing allows the breeder to evaluate how his animals compare within his herd. All associations should sponsor and monitor performance testing in their country to improve their cattle. As differences exist in production systems, environments and markets, no one set of rules will meet all of the needs throughout the world.

ESTIMATED BREEDING VALUES. Estimated breeding values (EBV) or estimated predicted differences (EPD) are valuable tools for breeders. These estimates are only as good as their accuracy. Brahman estimates are mostly derived from within herd information on sires which limits their accuracy. The dairy industry uses artificial insemination over large numbers of farms and this results in high accuracy of EBV for economic traits. Accuracy of EBV or EPD estimates for Brahman cattle would be improved if bulls were evaluated in more herds.

This may not be done as the control of valuable genetic material is lost by widespread artificial insemination. Because of the lower accuracy in the Brahman breed, EBV's or EPD estimates must be used with caution. These estimates should be used as warning signals when selecting cattle.

VAIABILITY OF THE BREED AND ASSOCIATIONS. The Brahman breed is stronger in countries which include tropical or subtropical environments. These countries have growing numbers of Brahman cattle and Brahman breeders. In countries which are more temperate, growth in numbers of cattle and breeders is stagnate in some and decreasing in others. The Brahman breed remains a common denominator for crossbreeding in most environments. Use of the Brahman is expanding in many tropical areas for crossing with indigenous breeds.

Viability of the Brahman breed depends on breeders producing cattle with economic value for their market area. More temperate areas, with predominately Bos taurus breeds, have seen reduced use of Brahman bulls because of calving difficulty and marketing problems for their steers. Composite breeds based on the Brahman have made inroads into the commercial bull market in many areas of the world.

Strong maternal traits and hybrid vigor coupled with hardiness, tropical adaptation and ability to utilize low quality forages assure that Brahman cattle will retain a place in cattle production throughout the world. The Brahman breed is richly endowed with environmental adaptation, disease and parasite resistance, growth, feed efficiency, longevity and confirmation. Reproductive efficiency can be high in purebred cattle but is always greatest in Brahman crossbred cattle. The single trait that is almost always negative in the literature is carcass traits. As carcass traits in Brahman cattle have extreme variation, selection for carcass traits should be successful in the Brahman. At this time, there are several experiments underway trying to determine genetic control of carcass traits in Brahman cattle. If they meet with success breeders may have the opportunity to make dramatic improvements in carcass traits of their Brahman cattle.

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